

RF Amplifier

Quick Start Guide 498160-001

Motorola's STARLINE RF amplifier series share many common features, functions and safety precautions. This Quick Start Guide is intended to cover basic installation and operation procedures common to all amplifiers. To obtain complete product documentation and compliance information for your specific amplifier, go to <http://www.motorola.com/broadband> and click **HTML/Modem Version/Customer Support/Product Documentation/Manuals**.

Before you begin to install your amplifier, verify the model number and confirm that it accurately reflects the product configuration and options that you ordered.

CAUTION!



To avoid possible injury to personnel or damage to the equipment, remove 60/90 volt ac power from the system before you install the amplifier.

Document Conventions

Before you begin using the RF Amplifier Quick Start Guide, familiarize yourself with the stylistic conventions used in this manual:

- SMALL CAPS** Denotes silk screening on the equipment, typically representing front- and rear-panel controls and input/output (I/O) connections, and LEDs
- * (asterisk)** Indicates that several versions of the same model number exist and the information applies to all models; when the information applies to a specific model, the complete model number is given
- Italic type*** Denotes a displayed variable, or is used for emphasis

Installing the Housing

STARLINE amplifiers are mounted horizontally below the strand or on a pedestal. To reduce the weight of the amplifier and prevent possible damage, it is recommended that you remove the electronics chassis before you install the housing.

To install the amplifier on the strand, use the two strand clamp assemblies located on the long side of the housing and torque to 10 to 12 ft-lbs.

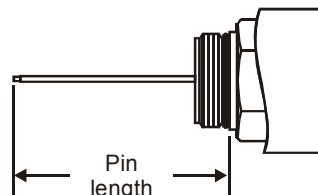
To install the amplifier on a pedestal, use the bolts from the strand clamps and the two holes on the bottom of the housing. Torque the bolts to 10 to 12 ft-lbs. The centerline distance between the holes on the bottom of the housing is:

Amplifier Model	Distance Between Hole Centers (inches)
BLE*/*	4.0 vertical centerline
MB*/*, MBE*/*	7.7 horizontal centerline
BT*/*	11.0 horizontal centerline

Installing the Coaxial Cables

Connections to the housing are made using standard KS-type housing port entry connectors. Pin-type connectors with a nominal center conductor diameter of 0.067 inches are required. The following table provides the center conductor pin length for the various amplifiers:

Amplifier models	Pin length (inches)
BLE*/*, MB*/*, BT*/*, MBE*/*	1.50 minimum to 1.65 maximum



Use a torque wrench or Phillips screwdriver to tighten the center conductor seizure screw to a torque of 12 in-lbs.

Powering the Amplifier

For optimal operation, verify that the ac input from the feederline to the power supply is between 38 and 90 Vac (rms) with a line frequency of 50 or 60 Hz. The waveshape of the input voltage must be quasi-squarewave.

The power supply provides the additional feature of a two position (LO and HI) selector that sets the **startup voltage** of the power supply. The startup voltage is 38 Vac for the LO position and 55 Vac for the HI position. All units are shipped with the selector set in the LO position. The LO position is used with 60 Vac systems where 38 Vac startup voltage is required. For systems operating at 90 Vac, the selector can be in the LO or HI position. Note that changing the selector does not change the upper voltage limit but affects only the startup voltage. The voltage selector should be switched only if the power supply approaches its maximum load rating.

*There is no damage to the amplifier if the jumper is not changed. However, changing the jumper ensures that the dc supply does not turn on until the proper input voltage level is reached — either 38 Vac or 55 Vac. This prevents excessive loading of the **system** power supply during turn-on after a system shutdown.*

DANGER!



Voltages up to 90 Vac are accessible. To avoid a shock hazard, confirm that the STARLINE amplifier is not powered before removing the cover or replacing the fuses.

To power the amplifier:

- 1 Set the power supply jumper for 90 Vac operation if required by your system.
- 2 Determine which fuses should be installed to route power to the appropriate ports.
- 3 Verify that the power supply output voltage is +24 Vdc.

Forward Path Alignment

The following subsections describe procedures required to obtain proper forward path alignment.

Before You Begin

For proper forward path alignment obtain:

- 1 RF output levels and tilts of all amplifiers
- 2 RF input level for the amplifier being set up (from system design or as-built map)
- 3 A carrier at the system's highest frequency. It can be modulated or continuous wave (CW) and should be inserted in the headend at standard video levels. This carrier is used to simplify field set up.

It is recommended that you:

- 1 *Install the system design value SFE-**-* and a high value (20 dB or above) forward input pad before you install or remove the electronics chassis or activate the system.*
Leave the forward input pad location open if a high value pad is not available. A more accurate forward input test point reading is achieved with a high value pad installed.
- 2 Do not use wire jumpers to bypass the SFE-**-* location.
- 3 Recognize that actual pad and SFE-**-* values may differ slightly from their design values. This is caused by factors such as walkout errors, worst-case data utilization during design and temperature variation from 70°F.
- 4 Secure the electronics chassis in the housing and torque to 18 to 22 in-lbs to facilitate heat transfer.
- 5 Perform a bench alignment. Pre-aligning the amplifier response on the bench for system signature simplifies field alignment. *(If the unit is bench aligned properly, only minor adjustments may be necessary in the field.)*
- 6 Field sweep the entire bandwidth of the amplifier in the field to correct frequency response for passive signature and roll-off.
- 7 Close the housing in accordance with the instructions provided in the subsection Closing the Housing at the end of this guide.

Manual Gain Control

To adjust manual gain control:

- 1 Verify that the electronics chassis is installed correctly.
- 2 Ensure that there is continuity in the forward path by installing the design value SFE-**-* and design value input JXP-**B attenuator.
- 3 Ensure that the drive control select jumper is in the MAN position.
- 4 Use a signal-level meter to measure the high band-edge carrier-input-level at the input test point: 750 MHz = channel 116, 870 MHz = channel 136. This carrier should be at standard analog level, non-scrambled.

- 5 Verify that the input level agrees with the design specification input. If the level is different from design, adjust accordingly.

For example: the design level is 19 dBmV at the highest frequency and the design pad value is JXP-3B. If the actual measured level is 21 dBmV, then you must change the pad to a JXP-5B.

If the actual levels are significantly different from the design levels, it is recommended that you investigate or consult system management before proceeding.

- 6 Connect the signal level meter to the output test point and tune the meter to the high-end channel.
- 7 Turn the manual gain reserve (MAN) control to maximum (fully clockwise) and then reduce the output by the amount indicated below:

Amplifier	Above 110°F	32°F to 110°F	Below 32°F
BLE*/*	3 dB	4 dB	5 dB
MB*/*	4 dB	5 dB	6 dB
BT*/*	4 dB	5 dB	6 dB
MBE*/*	3 dB	4 dB	5 dB

- 8 Check the amplifier output tilt by measuring the high band- and the low band-edge carriers:

- High = channel 116 (745.25 MHz) or channel 136 (865.25 MHz)
- Low = channel 2 (55.25 MHz) or channel 3 (61.25 MHz)
- If the tilt is less than required, install a higher value SFE-*-*
- If the tilt is greater than required, install a lower value SFE-*-*
- If the high value equalizer provides too much tilt and the low value equalizer provides too little tilt, use the lower value equalizer. Under-equalization is preferential to over-equalization.

- 9 You must adjust the input pad if you use a STARLINE Cable Simulator (SCS-*) and the design value is changed.

For each 1 dB increase in SCS-* value, 1 dB of loss is introduced at 750 MHz or 1.1 dB of loss at 870 MHz. Therefore, to maintain a proper gain level it is necessary to adjust the input pad value as follows:

- For each increase in SCS-* value, decrease the input pad by 1 dB.
- For each decrease in SCS-* value, increase the input pad by 1 dB.
- If you replace an SFE-*-* with an SCS-*, reduce the value of the input pad by the value of the SCS-*.

- 10 Measure the output level at the highest frequency. It should be within 1 dB of the system design level. If it is not, you must adjust the interstage pad and/or the output pads accordingly.

The input pad is normally changed to accommodate excessive input levels. Because it only attenuates excess signal, it has no effect on the overall performance of the amplifier.

If necessary, to achieve the gain specification, you can use the interstage pad or output pads to reduce the gain of the amplifier. However, this will affect amplifier performance. Output padding degrades the station distortion performance while having minimal effect on the carrier-to-noise (c/n) performance. Interstage padding is the opposite and therefore has little effect on distortions but degrades the c/n performance. In general Motorola recommends that you pad to the amplifier gain specification on the output (where possible). However, if you are unsure about the optimal padding technique for your system, split the required padding evenly between the interstage and output pad(s).

It is recommended that you contact Motorola's TRC or your account representative for more specific information regarding use of the interstage and output pads.

Thermal Drive Unit

To use the thermal drive unit (TDU):

- 1 Place the jumper on the TDU to the LOW, MEDIUM, or HIGH position to specify the amount of cable for which the TDU compensates at the highest frequency preceding the amplifier station.

Low = 0 dB to 15 dB, medium = 15 dB to 30 dB, and high = 30 dB or more of cable.
- 2 Position the drive control select jumper temporarily in the MAN position and perform the complete procedure described in Manual Gain Control if not already completed.
- 3 Position the drive control select jumper to DRIVE UNIT.
- 4 Connect a signal-level meter to the FWD OUT test point and tune the meter to the high band-edge carrier.
- 5 Turn the thermal level potentiometer on the TDU fully clockwise and then reduce to obtain the level stated in Step 7 under Manual Gain Control.

Automatic Drive Unit

To use the automatic drive unit (ADU):

- 1 Position the drive unit select jumper temporarily to the MAN position and perform the complete procedure described in Manual Gain Control if not already completed.
- 2 Verify that the frequency stamped on the ADU control unit is the same as the system pilot frequency.

The pilot frequency is a CW pilot or available NTSC television channel not scrambled using sync suppression.
- 3 Position the drive control select jumper to DRIVE UNIT.
- 4 Connect a signal-level meter to the FWD OUT test point and tune the meter to the high band-edge carrier.
- 5 Turn the auto level control potentiometer (ADU) fully clockwise and then reduce to obtain the level stated in Step 7 under Manual Gain Control.

ADU Pads and Levels

A JXP pad is installed in the input line to the ADU location. This pad adjusts the ADU input level for the standard application of the amplifier. This pad may be changed depending on the operational output of the amplifier.

In general, the following JXP pad values are recommended in the amplifier ADU circuit and are the standard values installed at the factory.

Amplifier	Pad	Amplifier Output Level Range
BLE*/*	JXP-6	+42 dBmV to +50 dBmV at 550 MHz
MB*/*	JXP-14	+42 dBmV to +50 dBmV at 550 MHz
BT*/*	JXP-6	+41 dBmV to +51 dBmV at 550 MHz
MBE*/*	JXP-0 or JXP-ZX jumper	+31 dBmV to +38 dBmV (trunk) and +40 dBmV to +47 dBmV (bridger) at 550 MHz

To determine the correct ADU pad value for other output levels:

- Increase the ADU pad by 1 dB for every 1 dBmV increase in output level.
- Decrease the ADU pad by 1 dB for every 1 dBmV decrease in output level.

The levels for the MBE*/* assume a bridger gain 9 dB higher than the trunk.

Return Path Alignment

The following subsections describe procedures required to obtain proper return path alignment.

Before You Begin

For proper return path alignment obtain:

- 1 RF alignment levels and insertion points for all amplifiers
- 2 RF reference output level of the headend optical receivers
- 3 A full complement of JXP-*B pads and SRE-*-* return equalizers
- 4 A reverse signal generator that produces at least one signal within the return bandpass and has a variable output
- 5 Return sweep or alignment equipment

It is recommended that you:

- 1 Do not use wire jumpers to bypass the SRE-*-* location.
- 2 Set up the return optical link before you perform the amplifier set up.
- 3 Specify reverse alignment design levels for a single carrier.
- 4 Consider sweep equipment as a single carrier and operate at design levels.
- 5 Do not include injection point losses in reverse design levels.

If JXP THERM devices (JXP-TH*B) are specified for level control, they need to be installed in the JXP THERM pad facility.

Alignment Procedure

To align the return path:

- 1 If the amplifier is powered, remove all fuses before you perform the following steps.
- 2 If necessary, carefully install a return hybrid amplifier.
- 3 Ensure that both hybrid screws are tight. Torque the screws to 10 to 12 in-lbs. Over torque can damage the hybrid.
- 4 Install the design value pad in the return output pad location.
- 5 Install the design value SRE-*-*.
- 6 Verify that the return input pad locations have 0 dB pads (or JXP-ZX jumpers) installed.
If the optional ICS is ordered, verify that the switch(es) are installed in the ICS location(s). Otherwise, leave the factory-installed jumpers in the ICS location(s).
- 7 Verify that any remaining return pad locations have 0 dB pads (or JXP-ZX jumpers) installed.
- 8 Verify that the JXP THERM pad location has a 0 dB pad (or JXP-ZX jumper) or a JXP-TH*B installed.
- 9 Set the sweep equipment output level to the amplifier's design input level. Add insertion point loss.
- 10 If required, change the return output pad and/or SRE-*-* to achieve, as close as possible, a match of the reference level as compared to the node.
- 11 Verify the sweep response of all insertion points if applicable.
- 12 Verify that the pad and SRE-*-* values are similar to the map design values.

You can verify proper return alignment by injecting a carrier, at the design level, into any amplifier at random. Proper alignment is achieved if you observe the reference level at the headend optical receiver output.

Return levels used for alignment are not necessarily operational system levels. These levels vary from system to system due to differences in equipment, architectures and design philosophies.

For an in-depth analysis and discussion of the return path, refer to Motorola's *Return Path Level Selection, Setup and Alignment Procedure*.

Closing the Housing

Before you close the housing:

- 1 Record all pertinent information as required.
- 2 Secure the electronics chassis in the housing and torque to 18 to 22 in-lbs. This facilitates heat transfer and reduces damage caused by overheating.
- 3 Verify that the electronics chassis cover screws are torqued to 10 to 12 in-lbs.
- 4 Check the condition of the RF and weather gaskets and replace them if necessary.
- 5 If applicable, ensure that the electronics chassis handles are folded down and the cable between the power pack and electronics chassis is not pinched.

- 6 Close the housing and use a torque wrench to sequentially and progressively tighten the housing bolts in the sequence specified on the housing cover.

Torque the housing bolts to the following specifications:

Amplifier	Torque (ft-lbs.)
BLE*/*	6
MB*/*, MBE*/*	12
BT*/*	15

If You Need Help

If you need assistance while working with the STARLINE amplifiers, contact the Motorola Technical Response Center (TRC):

- Inside the U.S.: **1-888-944-HELP (1-888-944-4357)**
- Outside the U.S.: **215-323-0044**
- Online: <http://www.motorola.com/broadband>, click **HTML/Modem Version**, click **Customer Support**, then click **Web Support**.

The TRC is open from 8:00 AM to 7:00 PM Eastern Time, Monday through Friday and 10:00 AM to 5:00 PM Eastern Time, Saturday. When the TRC is closed, emergency service *only* is available on a call-back basis. Web Support offers a searchable solutions database, technical documentation, and low priority issue creation/tracking 24 hours per day, 7 days per week.

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